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ABSTRACT

This paper examines the practices and accomplishments of the military in the area of instructional technology. An examination of historical background is used to increase the precision of the definition of instructional technology. Specific contributions of the military are described and then uses of instructional technology in the military and the academic community are compared. Finally, specific examples of applied instructional technology are described, and suggestions for the future are presented. (CH)

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ACADEMIC AND MILITARY INSTRUCTIONAL TECHNOLOGY

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INTRODUCTION

It is the purpose of this paper to examine the practices and accomplishments of the military in the area of instructional technology and to make some observations about the future. The approach will be to examine briefly the history of instructional technology as a means of increasing the precision of the definition. Then, specific contributions of the military to instructional technology will be described. From there, comparisons between the military and academic communities will be made wherever possible, particularly in management philosophy and mission. Finally, specific examples of applied instructional technology will be described for each environment and predictions and suggestions for the future will be presented.

Two frequently asked questions when one discusses systematic education and training are: a) what is instructional technology and b) how did it all get started? These questions are difficult to answer. Unlike the tracing of modern aviation to the Wright Brothers or the telephone to Alexander Graham Bell, there is no single event which can be described as the origin of instructional technology.

On the one hand, if one accepts the rather limited definition of what instructional technology is--things--advanced by Armsey and Dahl in 1972, it becomes relatively easy to say when these things first became available. Photography, motion picture photography, television, radio, voice recording, music recording, and so on, represent various aspects of what might be narrowly defined as the things of instructional technology. However, all of these pieces of equipment existed before instructional technology was practiced, and, instructional technology has been effectively and ingeniously applied without the use of any of them. Thus, while many processes and pieces of equipment have been available for a long time they have only recently been systematically applied using the principles of instructional technology.

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ORIGINS OF INSTRUCTIONAL TECHNOLOGY

It is perhaps more appropriate to look at the principles of instructional technology and then trace them back to their origins. Probably the single most important line of research which underpins the entire field is the study of the learning processes. The systematic investigation of learning by the experimental psychologists began in the mid-1880's and continues at a fervent pace today. Sometimes basic research on the processes of learning has yielded hypotheses which could be tested in existing classroom and training situations. Sometimes it has been possible to modify classroom or training methodology as a result of the outcome of specific experiments.

Pressey's work on teaching and testing machines first published in 1926, might be thought of as a landmark discovery. That is, Pressey found that a machine he had designed to test students efficiently had, as a serendipitous result, the effect of improving the performance of students who used it. Thus, the "teaching machine" was established.

Subsequent to Pressey's work, particularly at the beginning of World War II, a large number of psychologists were pressed into research and development efforts on behalf of the military services. Given specific problems, opportunities to do experiments, and a reasonable ability to apply the results of those experiments in real life settings, rather dramatic improvements were made in various applications of training technology. Simulators were devised and improved; training devices became much more wide spread than before; research based apparatus and equipment were directly applied to the solution of real problems. Human resources research during World War II, combined with what was later named human factors research, probably represents the origins of what is now called instructional technology.

Characteristics of that work included the specification of a problem to be solved, an appropriate task analysis procedure to describe it, a methodology for describing what needed to be learned, the exposure of trainees to that which was to be learned, the effective measurement of the performance of the trainees, and then revision of the training situation based on the results obtained in the experiment. Widespread applications of the final approach led to important improvements in methodology.

Skinner's 1954 article, "The Science of Learning and the Art of Teaching", and a later article on teaching machines were both influential during that period. A significant advancement in the state-of-the-art occurred when it was formally declared that instructional objectives ought to be stated in behavioral terms prior to the development of the instructional materials. Pressey had followed the procedure of analyzing existing learning materials for what students should get from them,

writing test questions to measure those outcomes, and administering the instructional materials and tests to the students. While Pressey's approach was clearly not to write what are now called "behavioral objectives" prior to construction of the instructional materials, he did operationally define his intended learning outcomes through the process of extracting test items from the content of material. While the battle hasn't raged for years, some researchers doubt whether behavioral objectives are truly superior to test items, per se, as statements of instructional intent. Evans (1967) elaborated this view clearly.

HUMAN RESOURCES RESEARCH

A concept emerged during the time between 1912 and 1950 which was that of attributing job performance to a combination of training, management, and selections factors. Probably the most dramatic application of this procedure occurred when Flanagan (1948) developed the pilot selection model for the Army Air Corps in the early days of World War II. By systematically analyzing components of job performance it is possible to increase the precision with which one goes about the job of training. Further, it enables greater economies and efficiencies to occur through the selection and placement of individuals in appropriate jobs.

Improvements in human resources management always seem to occur more dramatically following large scale military actions. This was certainly true following the Second World War, the Korean War, and the Viet Nam War. A significant period of development during this era was between the conclusion of the Korean Conflict and the beginning of Viet Nam. The Army, the Air Force, and the Navy all sponsored extensive programs in human resources development. Often these were staffed with individuals, working directly for the service who were located in laboratories in San Antonio, Denver, San Diego, and so on. At other times, this research was accomplished by private laboratories, corporations and universities.

In addition to the changes in training technology between the end of World War II and 1960, there were vast increases in the sophistication of the hardware and weapons system design. In the mid-1960's the Continental Army Command assembled a group of experienced instructional technologists for the purpose of drafting a regulation entitled "THE SYSTEMS ENGINEERING OF TRAINING" (Con Reg 350-100-1; 1968). During the late 1950's and the early 1960's the Air Force conducted extensive work in the area of programmed instruction, another of the processes of instructional technology. However, as those familiar with military operations well understand, there is a great deal of difference between the existence of a regulation and its effective implementation. Whether training is "systems engineered" depends on two important factors: the capability of the staff to execute the requirements of the regulations and the degree of emphasis placed on the regulation by the manager.

Thus, even though instructional technology and systematic approaches to instruction began in the military many years ago and regulations exist in each of the services which encourage the application of systematic procedures, these practices are not as widely known or well established as one might expect. There are related problems as well.

This brief history reveals a significant difference between the academic community and the military--one which makes them extremely difficult to compare. In the military, it is typical to identify problem areas, conduct research into alternative solutions, then attempt to implement the most desirable solution. In the academic community, this approach is not typical. It is common in the academic community to argue for years about what the problem is, and even when agreement exists on the problem, the systematic approach to a solution rarely occurs. That is a general statement which does not apply to individual scholars who use systematic methods to find solutions to specific problems. There are, however, discernable trends of improvement in the academic environment.

The military has continued to fund research in human resources development. It is proper that they should do this since the payoffs from such research have been impressive in times past. Why is it, then, that research sometimes pays off and other times does not? Of course, some research will be done which does not yield hoped for, or planned results and which simply does not provide good enough answers to make management decisions. That can be expected. However, many research studies do achieve important and worthwhile results; but, the conclusions drawn from that research are not exploited in the training environment. Thus, there exists a discrepancy of some magnitude between the production of knowledge by researchers, and the exploitation of that research in the design of training systems. Just why this should be so is not precisely clear.

Many arguements about centeralization, decentralization, and bureaucracy might be advanced. However, there is no agency charged with the responsibility of exploiting the research that has been produced. And, there are perfectly good organizational and bureaucratic reasons why this may be true. One of the more important reasons is that research by its very nature seeks different methods of doing things. People, by and large, are happy with the way things are now. Unless someone is specifically charged with discovering ways of doing things differently-more effectively, less expensively, or more quickly-he may prefer to retain the status quo.

NEW DEVELOPMENT IN SYSTEMATIC TRAINING

The most recent large scale effort in the development of a systematic approach to training is the publication of the Interservice Procedures

for Instructional Systems Development (Branson, et. al., 1975) (TRADOC Pam 350-30; NAVEDTRA 106A). This manual represents an attempt to implement an extensive set of training procedures designed to incorporate the state-of-the-art in instructional technology. The implementation plan includes the conduct of a large number of training workshops in order to provide users with the knowledge and skill necessary to perform the specific work. Further, the Army and Navy have both issued instructions and guidance to their schools to follow these or similar procedures in the conduct of training. These manuals represent a significant attempt to exploit a knowledge stockpile in the hope that the payoffs will more than justify the R & D expenditure upon which they are based.

While the existence of these manuals and the training to assist in their implementation is a necessary condition for the application of systematic techniques to training, it is certainly not a sufficient condition. A second necessary condition is the command emphasis required to get managers throughout the system interested in the application of techniques for systematic training. In order for those managers to become interested, there must be some kind of incentive for them; a carrot or a stick.

RESIDENT INSTRUCTION

During FY 1976 there was continued pressure on the budget and in order to maintain a constant state of readiness in a time where budgets are not expanding, training was an area which was looked at carefully. If there are ways to reduce the costs of training then it should be possible to increase the amount of money directed toward the pursuit of the primary mission. When one thinks about the possibility of reducing the costs of training, one of the first sources of those potential savings comes from analysis of the practices currently followed in resident schools. This focus may be caused in part because it is so easy to isolate the costs associated with resident school instruction: the resident school is a place, there are people there, the cost accounting is relatively simple.

There have been many attacks on the practices followed in resident school environments. If money was short it was often expedient to issue a directive to the commander of a school instructing that he cut three weeks out of "course X". While this may do nothing at all to improve the cost-effectiveness ratio, it does reduce costs in that environment immediately; the cost reduction is accomplished through a reduction in service. The fact that this reduction can be accomplished at all perhaps suggests that the service may not have been a high priority originally. The academic community often accomplishes this same purpose by increasing the number of people in a class.

While cost reduction may be a prime factor in the decision to reduce resident instruction in the military, there are other considerations in both the military and civilian environements which may require alternatives. One problem that many people have is the inability to access a resident institution when they have a need for the instruction provided by that institution. Universities have approached this problem by offering extension courses where faculty members are sent to remote locations to provide courses. Military services have also used this approach.

In addition to the vast changes in weapon system hardware and in the approaches in instruction that have come about during the last twenty-five years, there has also been a revolution in attitude toward the provision of instruction to all qualified learners. Just as the United nations has tried to establish free universal primary education as a basic human right, access to higher education for those who benefit from it is thought of as an emerging right or a significant privilege by a large number of people throughout the world. The British evolved the concept of the "Open University" through which courses for university credit could be provided to individuals in remote locations via systems designed courses available in a variety of delivery systems. In this country, the State of New York and a consortium in the middle west have also begun to offer courses in a large number of locations. There are parallel activities in the military.

Non-resident instruction is now often the chosen approach instead of being thought of only out of necessity. At the same time that instruction is increasingly offered in remote locations there is also a shift in attitude from that of certifying <u>time in attendance</u> in a resident school to that of certifying the achievement of certain <u>competencies</u> defined as critical to the mastery of subject matter areas. That is, it has become increasingly possible for individuals to obtain university credit through the means of passing examinations (e.g. CLEP, etc.), and this total rethinking of university instruction from a socializing process to that of a competency developing process heralds a new era of thought.

Instructional technology has provided techniques for accomplishing a large number of purposes but, until these purposes are desired there can be little application of those techniques. For example, self-paced learner controlled instruction can be designed to produce learning of a high quality. That is, if one were to apply absolute quality control standards, systems designed instruction would be far more likely to achieve design specifications than traditional instruction. So while the philosophical emphasis is shifted from socialization and time in attendance to competency, at the same time the technological basis for providing effective instruction has increased.

A careful audit of the courses in military resident schools has confirmed the suspicion that many of these schools proliferate instruction quite independent of the "need to know" for job performance. The application of modern techniques for occupational analysis have made this proliferation more apparent. Further, studies of job performance competencies have often indicated that job incumbents do not perform to an optimum level because they have forgotten that which was taught in the school environment. In order to overcome this problem, many organizations have gone to exportable instructional packages so that job incumbents can review the material from time to time. Further, there are variations in the quality of people available to the military. Variations in the country's economy, increase or decrease the number of people who sign up for the military under the all volunteer force concept. When the economy is booming, both universities and the military have a difficult time in recruiting to meet their total capacity. However, when the economy is experiencing a significant downturn the opportunity in the military to acquire more talented individuals increases dramatically. At the same time, a larger proportion of age eligible students attend college.

Other recent trends in the provision of instruction in resident and remote locations have been brought about by thoughtful applications of the principles of instructional technology. In the university environment, this process is often referred to as independent study. Here, a student signs up for a course and is provided with the objectives and expectations along with the course study materials. Independently, the student progresses through the materials, adds whatever additional independent research is required and, from time to time, presents himself to a professor for examiniation and review. Industrial applications of this concept occur when learner controlled instruction is applied. Mager and McCann (1961) described an appropriate application of learner controlled instruction for project engineers with Varian Associates. There, individuals were given instructional objectives and expectations and were provided access to those members of the staff who could tell them what they needed to know and provide them with appropriate study materials. When they completed their study, they passed an examination and review which entitled them to a promotion. The results indicated a reducation in time of about half to achieve this result.

Recently, the Army designed and implemented an Enlisted Personnel Management System (EPMS) (Roberts, 1975) which provides the soldier with a clear description of the Army's expectations of him at any point in his career. In addition, the EPMS, through the Soldiers Manual, provides a listing and description of the competencies a soldier is expected to achieve and the method or opportunities available to him to achieve them. Providing adequate and effective instruction in a non-resident environment can be accomplished with

an increasing degree of confidence.

Lecznar (1972) reported the results of a study conducted by the Air Force in which trainees followed one of two paths to a duty assignment. The first group was assigned to resident school training. The second group was sent directly to duty assignments following basic training. While the cost of the on-the-job training was significantly lower than the cost of the resident school environment, the results indicated that those individuals sent directly to duty did as well or better in their jobs as individuals who were first sent to technical schools. One difference between these two groups was that the technical school graduate was asked to perform significantaly fewer tasks, out of the total expected in the speciality, than the individual who was sent directly to duty. Thus, a significant role for on-the-job training is more clearly defined. Often, in the civilan academic environment, people cannot get a job without a school certificate. From an occupational and income standpoint a college degree may now not be a good personal investment of time and money.

DIFFICULT COMPARISONS

One of the difficulties in trying to directly compare instructional technology in the military and academic community lies in their distinctly varying purposes. The university, with the exception of trade and professional schools, is orientied primarily toward the general preparation of students to have compentency in a subject matter. Competency in a subject matter does not equate, except in rare instances, to preparation for employment in a position.

While it oversimplifies the question somewhat, the military has a known quantity of available positions rigidly, specified on an organizational chart, for which reasonable job analyses can be performed. There are a finite number of MOS in the Army and ratings in the Navy which may change from time to time, but nevertheless remain relatively stable over longer periods of time. Contrary to many contemporary criticisms, the university is not principally designed and organized to promote the employment of its graduates. While the university is not indifferent to questions of employment, its principal fundtions are to develop and disseminate new knowledge, to share this knowledge with students by teaching, and to serve the public through the means of sharing knowledge in a larger context. If a student goes to the university and takes courses in the humanities it is not expected that he will find employment in that field. Rightly or wrongly, the study of the humanities is believed to be important in its own right and not a prerequisite to the learning of something else. Conversely, if one is enrolled in the College of Law, the College of Engineering,

or the College of Medicine, it is reasonably certain that one has clear occupational aims directly related to the course of study. It may not mean that there is a job available in that area of interest, merely that the individual is interested in working in the field or learning about the field.

Even so, there is still a strong belief and commitment that people not only have the privilege to attend an institution of higher learning, it is thought of as an emerging right. At a time when market economics would suggest that we should curtail enrollment, we find increases in enrollment. Further, through the development and implementation of a variety of approaches to non-resident instruction there has been a dramatic increase in the number of students who can be served by the system.

At the same time, many departements within universities and many public school systems, faced with drastic reductions in revenues, are seeking ways to economize. Instructional technology based courses such as independent study, computer-managed instruction, and some forms of broadcast media instruction have been successfully applied.

So what is to be compared? Unlike an art, a technology does not exist for its own right. A technology ought to yield payoffs of some kind for successful application; reduction in costs, increases in performance or service, or both.

Since it is difficult to compare the relative quality of applications of instructional technology within the military and academic communities, it might be fruitful to describe exemplary programs in both and then see to what extent they might parallel each other. First, in the areas of computer-assisted instruction or computer-managed instruction there are large scale applications of both of these in each community. In the Navy, the PLATO system is used as a part of the total fleet introductory training program for they S3A anti-submarine warfare aircraft. In this application, PLATO is potentially a cost-effective application of instructional technology since the flight training costs of the aircraft with crew exceed $4,000 per hour. In one sense, any approach which yields equal performance and which costs less can be said to improve cost-effectiveness considerations. Merrill, Towle, and Merrill (1975) have reported computer-assisted instruction rates with PLATO of between $2.50 and $7.00 per student hour, with all known costs fully amortized in a university environment.

In the academic application, the costs are lower, in large part, because of the assumptions about the number of people who will use the system. Further, there is really no reasonable alternative to the powerful high-speed computer (CDC CYBER 73/CDC6400) when working difficult problems in physics and similar courses. A part of the

advantage is gained because the computer would have to be used as a computer (not a teaching machine) in any event. Is PLATO cost-effective in the academic environment when compared to the Navy? The answer probably depends on the alternatives available. It may be that for some academic instruction, there is no alternative to the computer/PLATO combination. The argument could continue for years. However, it is unlikely that the computer will be substituted for faculty--hence, the costs may continue to be additive.

Because of the availablility of learning centers in many military installations, it is possible to use audiovisual media for a variety of applications. In support of EPMS, the Army has developed a series of Training Extension Courses (TEC) in audiovisual, audio only, and print formats. These TEC lessons are intended to provide specific "how-to-do-it" instruction on a large number of tasks within the Army. Roberts (1975) has described this program in more detail.

Jeon (1976) found that a TEC lesson which fully utilized the capabilities of the audiovisual system (the Beseler Cue/See), including selected motion sequences, was significantly more effective and required significantly less time than slide tape presentations or print media. In all instances, the soldiers were required to learn specific maintenance and operating tasks of the M203 Grenade Launcher while using the lesson in the approved format. Hands-on training, mediated through audiovisual instruction, exported from the development center to operating field units can produce the desired level of effectiveness if appropriate principles of instructional technology are followed.

THE FUTURE

It is not productive to describe a large number of examples of instructional technology applications--a few highlights should serve our purpose here. What is important is the realization that more and more people are now able to distinguish between the things of instructional technology and the principles of instructional technology. Further, more and more people can distinguish between the means of instruction and the planned ends. In many places "self-pacing" becomes an end in itself rather than a means to achieve acceptable performance and cost data. "Individualized instruction" is often described as an end rather than a means.

What will be important in the future is the application of whatever means necessary to accomplish the ends required--to achieve the mission. "Winning the first battle of the next war" is an end worthy of our attention. If instructional technology can contribute to that end through improving the knowledge and skill of the people who must engage

in the battle, then it will have made a contribution. But, to have instructional technology for its own right is not likely to have significant payoffs. Our future attention should be devoted toward the discovery of the knowledge and skill which will directly contribute to the achievement of the mission, establishing this knowledge and skill effectively and efficiently in the trainees, and searching for more effective and efficient ways to accomplish this purpose.

The effective application of the principles of instructional technology faces three massive problems in the military and academic communities:

1. The "humanist" vs. "technologist" controversy. How does one reconcile the logical problem presented by those who argue that a life support machine is a humane life-saving device, but that a computer which increases the probability that children will learn what they need to know is a dehumanizing and degrading instrument?

2. Even if all those in the military and the faculty of the university wanted to know the principles of instructional technology now it would require a massive effort to make them proficient.

3. Once having made them all proficient, they move around from job to job and place to place. How does one institutionalize the principles of instructional technology for a period long enough for them to be routinely applied, not by experts and contractors, but by journeymen, civilians, officers, and senior NCOs?

If more people could apply the principles of instructional technology and were required to do so by management, dramatic improvements could be made in the training system. Dramatic improvements in the training system should result in important increases in job proficiency. If there are discrepancies now in job performance caused by inadequate training, then it isn't likely that perpetuating the existing approach can solve the problem.

To abandon, evolve, or change the existing approach is an extremely difficult and frustrating effort. Vested interests and the common inertia which affect us all are formidable opponents to innovation and improvement. Many successful applications of instructional technology have been abandoned even after having been proved effective for a variety of reasons. Nevertheless, the fact that it is a frustrating, difficult time-consuming, and often seemingly impossible task to institute these changes does not excuse the professional from his obligation to continue trying.

REFERENCES

Armsey, J. W.; & Dahl, N. C. An inquiry into the uses of instructional technology. New York: Ford Foundation, 1973.

Branson, R. K.; Rayner, G. T.; Cox, J. L.; Furman, J. P.; King, F. J.; & Hannum, W. H. Interservice procedures for instructional systems development (TRADOC Pam. 350-30 & NAVEDTRA 106A) (5 vols.). Ft. Monroe, Va.: U. S. Army Training and Doctrine Command, August, 1975.

Department of the Air Force. Handbook for the designers of instructional systems (AFP 50-58, 5 vols.). Washington, D. C.: Headquarters, United States Air Force, July, 1973.

Evans, J. L. Behavioral objectives are no damn good. In Technology and innovation in education. Washington, D. C.: Aerospace Education Foundation, 1967.

Flanagan, J. C. (Ed.). The aviation psychology program in the Army Air Force (Report No. 1). Washington, D. C.: U. S. Government Printing Office, 1948.

Jeon, U. H. Effectiveness of image and motion variables in motor skill learning. Unpublished doctoral dissertation, Florida State University, 1976.

Lecznar, W. B. The road to work: Technical school training or directed duty assignment? (AFHRL-TR-72-40). Lackland Air Force Base, Tex.: Personnel Research Division, Air Force Human Resources Laboratory AFSC), April, 1972. (NTIS No. AD-754 845).

Mager, R. F.; & McCann, J. Learner-controlled instruction. Palo Alto, Ca.: Varian Association, 1961.

Merrill, J. R.: Towle, N. J.; & Merrill, P. F. Florida's instructional development effort using PLATO. Journal of Computer Based Instruction. June, 1975.

Pressey, S. J. A simple apparatus which gives tests and scores--and teaches. School and Society, 1926, 23, 373-376.

Roberts, W. K. Interservice Procedures for Instructional Systems Development: Implications for Army training. Paper presented at the Military Testing Association Annual Meeting, Indianapolis, Ind., September, 1975.

Roberts, W. K.; Lawson, W. G.; & Neal, W. D. TEC: A Manhattan Project in educational technology (76986 Army). Ft. Benning, Ga.: U. S. Army Combat Arms Training Board, September, 1975.

Skinner, B. F. The science of learning and the art of teaching. Harvard Educational Review, 1954, 24, 86-97.

Skinner, B. F. Why we need teaching machines. Harvard Educational Review, 1961, 31, 377-398.